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MINERALOGY.—*Crystallized chrysocolla from Mackay, Idaho.* JOSEPH B. UMPLEBY, Geological Survey.

Crystallized chrysocolla has been found only in a few places, and descriptions of its optical properties do not agree.[1] It seems worth while, therefore, to describe briefly some exceptionally good material from the Empire copper mine, situated three and one-half miles southwest of Mackay, Idaho. The specimen analyzed was picked from the ore bins of the Copper Bullion tunnel during an examination of the deposits by the writer in 1912. Copper silicate ore has afforded most of the production from these deposits, but very little of the material is crystallized.

The chrysocolla is characteristically brown in color and contains much iron, but locally it is bluish green and free from iron. The latter variety only is described in this paper.

The crystallized chrysocolla at Mackay occurs as mammillary crusts, as small masses of irregular shape, and as acicular crystals imbedded in other copper minerals. The acicular crystals are microscopic in size and in the thin section appear both as radiating groups and narrow bands of closely packed individuals oriented normal to the sides of the bands. The massive variety offered the best material for analysis, but even with it considerable difficulty was experienced in separating a sufficient amount for chemical examination. Within distances of a few millimeters

[1] A description of chrysocolla from the Belgian Congo, by H. Buttgenbach (Ann. Soc. geol. publ. Congo Belge, p. 31–70, 1913) gives the following optical properties: fibres, uniaxial +, mean index of refraction 1.39 (average of 6 readings from 1.33 to 1.48); mostly second order colors. Lindgren (Prof. Paper 43, U. S. Geol. Survey, p. 113, 1904) states that chrysocolla from Clifton-Morenci, Arizona, is negative with double refraction about like augite.

the pure material grades into ferruginous chrysocolla and copper pitch ore, and traversing it are ill-defined layers of malachite; films of kaolin occur along minute fractures. The physical properties of this massive form are: hardness, about 3; density, 2.4 (Jolly balance determination not satisfactory, because of many minute fractures); luster, somewhat waxy; color, beryl green (Ridgway's color scale); streak, white; tenacity, brittle.

Examined microscopically both in refractive index solutions and in thin section the mineral is seen to have one distinct cleavage normal to the elongation and possibly one parallel to it, although what appears to be cleavage in the latter direction may be merely an overlapping of fibers. It is uniaxial, optically positive, has positive elongation, and is highly birefringent. The indices of refraction are W, 1.46 and E, 1.57 ±, a small variation in the values from different grains making it impossible to place a satisfactory value in the third decimal place. Thick grains show pleochroism in colorless (W) and pale bluish green (E) tones. The mineral belongs to the hexagonal or to the tetragonal system of crystallization.

PARTIAL ANALYSIS OF CHRYSOCOLLA, R. C. WELLS, ANALYST.

		RATIOS	APPROXIMATE MINERAL COMPOSITION	PER CENT
SiO_2	39.3	0.65	Chrysocolla	
CuO	32.0	0.40	CuO, SiO_2, $2H_2O$	87.3
H_2O	18.7	1.05		
Al_2O_3 (etc.)	2.4	0.02	Kaolinite $2SiO_2$,	
Fe_2O_3			Al_2O_3, $2H_2O$	4.5
FeO			Opal	
CaO	1.7	0.03	SiO_2, n H_2O	8.2
ZnO	3.6	0.05		
MgO	tr.			
	97.7			

A partial analysis of the massive material, carefully selected with a hand lens, was made in the chemical laboratory of the United States Geological Survey in order to make certain that the material was chrysocolla. Although the analysis is unsatisfactory in that it only totals 97.7 per cent, it is believed that the results prove that the crystalline substance is chrysocolla.

Prior to recasting the analysis into mineralogical composition portions of the pulp analyzed were examined in index solutions, in order to determine what compounds other than copper silicate should be recognized. Kaolinite is present along numerous cracks in the specimen, but it was impossible to estimate its relative amount. There is present, however, a considerable amount of amorphous material which breaks as does the chrysocolla and which has a refractive index lower than 1.45. It was identified as opal. One hundred grains were examined in each of ten portions of the pulp analyzed with the result that on the average 9 out of each 100 were opal, the maximum range being 5 to 14 with most of the counts approximating the average value. Many of the grains were in part amorphous and in part crystallized, so that the average value is based on numerous estimates in addition to the actual count. The percentage of opal in the material as thus determined corresponds well with that calculated from the analysis and serves as a check on the calculation. In the recasting of the analysis alumina was assumed to determine the amount of kaolinite; copper, zinc and calcium oxides to determine the amount of chrysocolla; and the balance was considered as opal. This gives an opal with 3.85 per cent of water, a reasonable amount.

ANTHROPOLOGY.—*Pan-pipes of Peru.* WILLIAM EDWIN SAFFORD, Bureau of Plant Industry.[1]

In 1887, while on a cruise in the South Pacific, the writer found in a prehistoric grave at Arica, on the coast of Chile near the Peruvian boundary, a pair of pan-pipes made of several graduated reeds, very similar in form to the syrinx, or fistula, of the ancient Greeks and Romans. This discovery inspired him with a desire to learn what he could regarding the occurrence of similar instruments in America and their possible connection with the classic instruments of the old world. Afterwards, while acting as commissioner to Peru and Bolivia, for the World's Columbian Exposition, the writer encountered at Puno, on the Peruvian shore of

[1] Read before the Anthropological Society of Washington at the meeting of March 3, 1914.

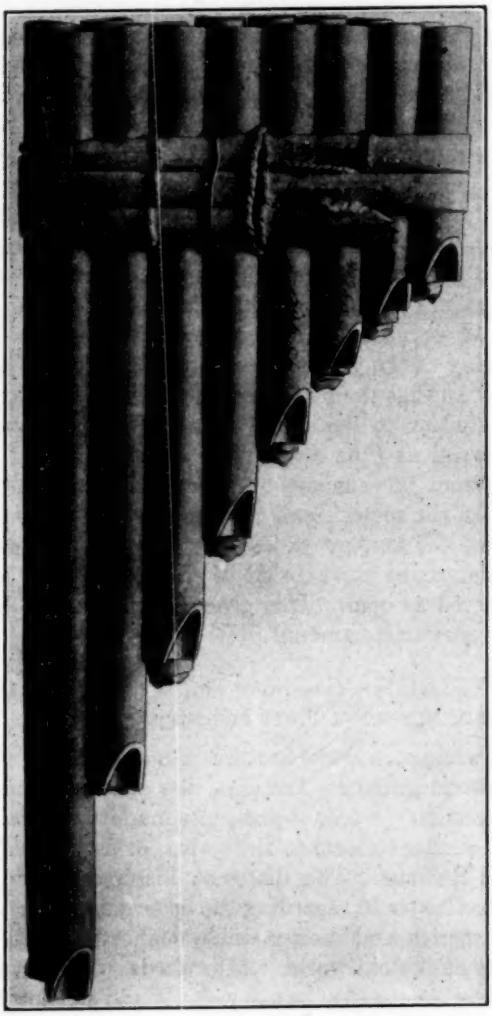


Fig. 1. Syrinx (*Huayra puhura*) from Peru. Photographed from a specimen in the U. S. National Museum (no. 95,908). About five-sixths natural size.

Lake Titicaca, an orchestra composed entirely of pan-pipes of various sizes, some of the instruments producing shrill notes like those of a piccolo, others flute-like notes, and the largest, tones like those of an organ or calliope.

It was observed that the instruments were always grouped in pairs. No single instrument was capable of producing all the notes of the scale, but only alternate notes, separated by intervals of a third, the intervening notes being played by a second player upon an instrument which was the mate or complement of the first. Nearly all the instruments consisted of 16 reeds arranged in 2 rows of 8 graduated reeds, those of the inner row closed at the bottom by a joint of the reed, while those of the outer row were open both at the top and bottom. The reeds were secured side by side, not by wax as in the Grecian syrinx, but by a splint of cane wrapped about them, the upper ends forming a horizontal line, the lower ends a series of steps, with the longest reeds on the right of the player when in use (fig. 1). The performers, who were full-blooded Quichua Indians, sounded the pipes by blowing across the opening of the inner or closed reeds, the corresponding outer open reeds apparently serving the purpose only of giving volume or quality to the note sounded. Some of the smaller instruments were composed only of 14, or 7 pairs, of reeds, but in other respects resembled the rest (fig. 2).

The lowermost instrument of each pair sounded the notes *mi, sol, si, re, fa, la, do, mi;* while its slightly smaller mate supplied the intervening notes *fa, la, do, mi, sol, si, re, fa.* The theme of one of the tunes played by the Titicaca Indians was the following:

This was repeated again and again. The time was quick and the Indians trotted along the street while playing, with short shuffling steps, keeping time to the music. When they arrived at a cross street and before the church they followed one another in ring, very much like the players represented on funeral vases from prehistoric graves. They wore close-fitting, pointed caps knit

partly of vicuña and partly of sheep's wool, some of them prettily figured with geometrical designs or conventionalized figures of viscacachas or llamas, but all of them more or less greasy. Over the caps they wore broad-brimmed gray felt hats wreathed with flamingo feathers of a pretty rose color or with feathers of other birds artificially dyed in bright shades of magenta, yellow, or purple. Over coarse white shirts they wore ponchos and over loose white drawers tightly fitting trousers slit from the lower margin of each leg to the knee and displaying the white drawers beneath. Some of them wore sandals of rawhide, but the majority were barefooted. On reaching the residence of the prefect they entered the court and stood in a ring while they played the national air of Peru in a creditable manner. The writer was informed by the prefect, Don José de la Torre, that these Indians came every year during the national festivities from their home on an island in Lake Titicaca, to pay him a formal visit. When they finished playing, he applauded them and cried *"sumahh,"* the Quichua word for good, or bravo! Then each player came before him and, bending one knee, bowed almost to the ground. The prefect patted each one on the head in succession, and then told them all to begone. Having regaled themselves with generous draughts of *pisco* they filed out of the patio and continued their procession through the streets of the town.

The instruments composing the orchestra were fairly well attuned. The middle pair, corresponding in pitch to the key of *c*, was composed of reeds varying in length from nearly 26 cm., producing the note *e*, to about 6.5 cm., producing a note exactly two octaves higher. The dimensions of the lower-toned pair were twice those of the middle pair, the pipes, ranging from approximately 52 cm. to 14 cm. in length (inside measurements), producing notes one octave lower. The smallest pair should have been one-half the size of the middle pair, but as a matter of fact, the component reeds were slightly short, and the resulting notes were consequently sharp. The effect of the whole orchestra, however, was not unpleasing to a musical layman.

On measuring the reeds composing the various sets of pan-pipes their lengths were found to correspond almost exactly with

the theoretical lengths of pipes producing corresponding notes of the diatonic scale. If the length of the *c* pipe be indicated by *L*, the *c'* pipe, an octave higher, measures one-half this length, or $\frac{1}{2}$ *L*, while the lower *C* pipe measures twice its length, or 2 *L*. The upper *g*, or sol pipe, which produces the fifth, or dominant, measures $\frac{2}{3}$ *L*, while the lower *G* pipe is twice as long as the latter, or $\frac{4}{3}$ *L*. The length of the upper *f* pipe, which produces the fourth, or subdominant, is $\frac{3}{4}$ *L*, while the lower *F* pipe is twice as long, or $\frac{6}{4}$ *L*. In the same way, we have the length of the upper *e*, or mi pipe, producing the major third $\frac{4}{5}$ *L*; the lower *E* pipe $\frac{8}{5}$ *L*; the upper *a*, or la pipe, $\frac{3}{5}$ *L*; the lower *A*, $\frac{6}{5}$ *L*; the upper *b*, or si pipe, $\frac{8}{15}$ *L*; the lower *B* pipe, $\frac{16}{15}$ *L*; that is, $\frac{1}{15}$ longer than the *c* pipe.

The pipes were not all cut with equal accuracy: sometimes a reed was a little too long or too short, consequently producing a flat or a sharp tone.

The following table shows the actual measurements in millimeters of the reeds composing the smallest pair of syrinxes in the United States National Museum. (No. 210,439).

	INSTRUMENT NO. 1 (8 REEDS)					INSTRUMENT NO. 2 (7 REEDS)			
	Notes	Proportional length	Theoretical length	Actual length		Notes	Proportional length	Theoretical length	Actual length
			mm.	*mm.*				*mm.*	*mm.*
1	*e* (mi)	$\frac{8}{5}$L	130	130	1	*f* (fa)	$\frac{3}{4}$L	122	122
2	*g* (sol)	$\frac{4}{3}$L	108	110	2	*a* (la)	$\frac{6}{5}$L	97	97
3	*b* (si)	$1\frac{8}{15}$L	86	87	3	*c* (do)	L	81	81
4	*d* (re)	$\frac{8}{5}$L	72	70	4	*e'* (mi)	$\frac{4}{5}$L	65	65
5	*f'* (fa)	$\frac{3}{4}$L	61	62	5	*g'* (sol)	$\frac{2}{3}$L	54	55
6	*a'* (la)	$\frac{3}{5}$L	48	49	6	*b'* (si)	$\frac{8}{15}$L	43	44
7	*c'* (do)	$\frac{1}{2}$L	41	42	7	*d'* (re)	$\frac{4}{5}$L	36	35
8	*e''* (mi)	$\frac{4}{5}$L	33	33					

It could hardly be expected that in making instruments so crude as these pipes, fashioned from simple reeds, the Indians should have an established standard pitch. Slight variations were found in different sets of instruments in the same orchestra, although an attempt had undoubtedly been made to attune them perfectly. An odd Peruvin syrinx in the collection of the United

States National Museum (no. 95,908, shown in fig. 1) has pipes producing alternate notes of the scale as above described, but they are in lengths which produce a scale in the key of *f*. The reed producing the tonic, or *do* tone (*f*) is 120 mm. long (inside measurement). The *fa* and *la* (*B*♭ and *D*) pipes below, theoretically $\frac{3}{2}$ and $\frac{4}{5}$ the length of the *do* pipe, are actually 180 mm. and 144 mm. long; the *sol* (c) pipe above theoretically $\frac{2}{3}$ the length of the *do* pipe, is actually 80 mm., and consequently sounds true; but the upper *re* and *fa* (*g′* and *b′*♭) pipes at the extreme left of the instrument are too long, and consequently almost a half-tone flat. It is probable that this irregularity was not intentional on the part of the instrument maker, especially if he gauged the length of the pipes by his ear alone rather than by definite measurements. Writers on musical instruments often show a tendency to give too great importance to accidental irregularities of this kind and to regard them as intentional. As a matter of fact, to correct a pipe for flatness the Titicaca Indians pour either water or a little pisco (grape brandy) into it, thus shortening the vibrating column of air to the required length. Specimens of flutes made of single reeds with holes for the fingers and thumb are sometimes dug up from prehistoric graves in Peru with the original holes plugged and replaced by new holes slightly above or below the original ones, showing that the first holes had been made by guess work and the resulting tones were too sharp or too flat for the ear of the player, who, finding his instrument to be "out of tune," felt obliged to correct it. In the same way, when the players of pan-pipes come together to form an orchestra, it is often necessary for some of them to tune their instruments to accord with the others. This is easily done by raising the pitch of the flat-toned instruments, as described above.

That pan-pipes are not an intrusion from Spain is proved conclusively by their occurrence in prehistoric graves. That the ancient Peruvians played them in mated pairs producing alternating notes in the scale is equally certain from the fact that on vases interred with mummies, players of pan-pipes are represented in pairs, sometimes with the two instruments on which they are performing connected loosely by a long string.

So far as the writer knows, this is the first account of the methods used by the Peruvians in attuning and playing their pan-pipes. The instrument is often represented in collections by a single specimen, and the alternating notes produced by it have caused no little wonder to observers unaware that they represented not a scale but only half the notes of a scale, requiring a second complementary instrument to make it complete.

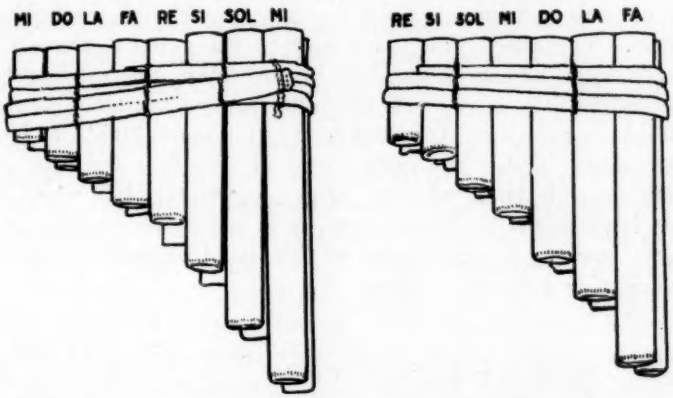
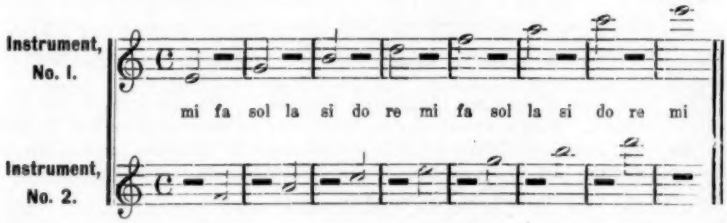


Fig. 2. A pair of syrinxes from Lake Titicaca. The two instruments are complementary. Both are necessary for producing the notes of the scale. Other instruments, also in pairs, are twice and four times the length of these. From specimens in the U. S. National Museum (no. 210,439) collected at Puno by W. E. Safford. About five-twelfths natural size.

Usually each instrument is played by a separate person; but the writer saw one expert performer who, to show his skill, played on two instruments at the same time, one superimposed upon the other, a feat evidently regarded by his companions with admiration. No melody can be played by a single instrument: a pair of instruments must always be used. What the original scale of the ancient Peruvians was is not definitely known, but this can be ascertained by measuring the lengths of the component reeds, even if they have been crushed and are incapable of yielding sounds. Undoubtedly they produced octaves, from the fact that there are always pipes one-half the length of larger pipes, and some

of these must have sounded the key-note or tonic chord. The Peruvians also recognized, in all probability, the notes of the major or minor third and the fifth, corresponding to the dominant drone of the bagpipe. This would be suggested by a natural harmonic or node in a single pipe, formed after the manner of the harmonic tones of a bugle. Whatever may have been their scale it is certain that they did use instruments in pairs to produce notes necessary for producing a melody; and the variation in size of their instruments point to their playing in symphonious chords. The alternating notes may be compared to those of a mouth-organ or accordion; but in the latter instruments the consecutive notes of the scale are produced by alternately blowing and inhaling the air. It would require too much breath to blow continuously across the open tubes of a syrinx: the resulting music would have a "wheezy" or gasping effect. But when the scale is produced by two players, it is pleasantly legato, each player having an opportunity of catching his breath while his mate is piping a note. Thus:



The pan-pipe may be regarded literally as the prototype of the organ, the graduated pipes of which suggest a giant inverted syrinx blown from below. In Peru the orginal Quichua name of the pan-pipe is *huayra puhura*, or "air-pipes;" but it is now usually designated as *zampoña*, a Spanish word corresponding to the Italian *zampogna*. This name is used ordinarily in Spain and Italy to designate bag-pipes, but is likewise applied to pastoral wind instruments of various kinds, just as in English we use the name "pipes." On the shore of Lake Titicaca the pipers held the pipe in the left hand, beating time with a stick, held by the right

hand on a drum suspended from the left arm. On some of the ancient Peruvian burial vases, instead of a drum, a hollow gourd is represented as the instrument for marking the rhythm.

The question as to whether the syrinx was invented independently by the aborigines of South America or whether it was brought to the western hemisphere from elsewhere is an interesting one. Certainly the instrument was wide-spread before the dawn of history. Syrinxes are found not only in Europe and on the southern shore of the Mediterranean but also in Java, on many islands of the Pacific Ocean, among certain tribes of North American Indians, as well as in northern South America, Brazil, Peru, and Bolivia. Whether their occurrence bears upon the problem of the origin of the American Indians is a question. The greatest caution should be exercised by the student of ethnology in tracing the origin of tribes by means of any one instrument or any single art. Often very similar arts are the result of similar conditions of climate and resulting raw materials. The art of weaving among the ancient Peruvians is very similar to that of the aborigines of Asia and Europe, yet it does not follow that this art was brought to Peru in prehistoric times. Llamas, alpacas, and vicuñas, are endemic in South America: why should not the art of weaving the wool obtained from these animals be equally of South American origin? It is a remarkable fact that the pan-pipes which are most closely similar in construction to those played by the Indians of Peru and Bolivia are found among the Solomon Islanders, especially those inhabiting the Florida Group —black-skinned, woolly-haired cannibals, in no way allied to the Indians of South America. Just as the orchestras of the Quichuas and Aymaras are composed of instruments of several definite sizes, so those of the Florida Islanders are similarly grouped; the shrill treble pipes being called *galevu-soniruka;* those of medium tone, half their size, *galevu-kahaumamu;* and the deeper, baritone instruments twice the size of the latter by the suggestive name *galevu-ngungu.* The instruments themselves, like those described above, consist of a double row of graduated pipes the reeds of one row being closed at the bottom by a natural joint, those of the other row being open.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal, and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

GEODESY.—*Interpretation of anomalies of gravity.* GROVE KARL GILBERT. U. S. Geological Survey Professional Paper 85-C. Pp. 37. 1913.

Hayford and Bowie, in discussing the deflections of the plumb line and the variations of gravity determined by the geodetic work of the U. S. Coast Survey, have introduced the following hypothesis: At a certain depth below the earth's surface, called the depth of compensation, stresses are uniform. Each vertical element above that level has the same mass, its density (assumed uniform) being low in proportion as its length is great. Under this hypothesis they find the most probable depth of the level of compensation to be 122 kilometers. The hypothesis approximately satisfies the requirements of gravity determinations for the United States but leaves certain residuals called anomalies of gravity. These have been ascribed to imperfection in the compensation. It is now pointed out that this explanation does not accord well with geologic data as to loading and unloading. Two alternative explanations are suggested, and computations indicate that each is quantitatively adequate: (1) The anomalies may be occasioned by inequalities in the vertical distribution of density above the level of compensation; (2) some of them may be occasioned by local inequalities of density within a rigid nucleus assumed to exist below the region in which mobility permits isostatic adjustment. These suggestions are in accord with a speculation as to the general structure of the earth,—that it includes a zone or layer of relative mobility, separating a superficial zone of less mobility from a highly immobile nucleus. The zone of relative mobility is the site of volcanic initiative, and is an important factor in those transgressions by which superficial tracts are tangentially shortened, as in the Appalachians, or tangentially extended, as in the Basin ranges. G. K. G.

GEOLOGY.—*Coastal glaciers of Prince William Sound and Kenai Peninsula, Alaska.* U. S. GRANT and D. F. HIGGINS. U. S. Geological Survey Bulletin 526. Pp. 75, with maps, views, and sections. 1913.

The history of the glaciation of the coastal region of Prince William Sound and Kenai Peninsula includes the formation of an extensive Pleistocene ice sheet, which extended to the sea and reached upward to the mountains. Since this period of maximum glaciation there has been a marked decrease in the extent of the ice-covered areas, until now only valley glaciers reach the sea. This withdrawal of the ice was probably punctuated by temporary advances, and the present is only an epoch in the long history since the maximum Pleistocene glaciation. Earth movements have also played a part, as yet little known, in this history; changes on Prince William Sound are still taking place, and since the maximum period of glaciation there has been a considerable sinking of the coast line in much of the area and between Resurrection and Nuka bays there are numerous drowned cirques. The glaciers here studied do not give uniform evidence as to a general retreat or a general advance within the last half century; some are evidently in a period of retreat and others in a period of advance, and the general balance between retreat and advance can not be accurately determined by data now at hand. A. H. BROOKS.

GEOLOGY.—*Geology and ore deposits near Lake City, Colorado.* JOHN DUER IRVING and HOWLAND BANCROFT. U. S. Geological Survey Bulletin 478. Pp. 128, with maps, views, and sections. 1911.

Lake City is in southwestern Colorado and in the heart of the San Juan Mountains. These consist chiefly of volcanic rocks, with intrusive igneous masses, which now cover an irregular area of more than 3000 square miles. The eruptions occurred during Tertiary time, when many kinds of lavas were poured out, building up a huge volcanic plateau. There were also long intervals of quiet, during which erosion changed the topography of the volcanic pile.

In general the Lake City lodes may be regarded mineralogically as the outer or northeasterly edge of the heavily mineralized area of the San Juan. The lodes occur at a slightly older geologic horizon than in the adjacent districts and are definitely characterized by formation at moderate depths. They are fissure veins, formed partly through the replacement of shattered and sheeted zones in the country rock and mainly through the filling of open spaces. They average between 500

and 1000 feet in length, have a similar vertical range, and an average width of 10 inches to 5 feet. They show a wide range of strike and dip at steep angles. They comprise three closely related mineralogic types. The first contains pyrite, galena, sphalerite, and chalcopyrite with subordinate tetrahedrite, in a quartz gangue with some barite and rhodochrosite, and yields silver and lead with subordinate copper and little gold. The second contains galena, sphalerite, and tetrahedrite, with subordinate chalcopyrite and pyrite, in a gangue of quartz, barite, and rhodochrosite, and yields chiefly silver and lead. The third contains petzite, tetrahedrite, and minor quantities of other sulphides, in a gangue of fine-grained quartz carrying in places some hinsdalite, a new mineral; this type yields silver and gold in proportion by value of 1:1 and is characterized by high tenor in both metals. The first two groups include most of the Lake City lodes, as there is but one productive telluride vein. The lodes are of late Miocene or early Pliocene age. Their materials are believed to have been emitted from a magma of monzonite whose apophyses as intrusions are scattered through this general region in considerable numbers. ALFRED H. BROOKS.

GEOLOGY.—*Some ore deposits in northwestern Custer County, Idaho.* J. B. UMPLEBY. U. S. Geological Survey Bulletin 539. Pp. 104, with maps, figures and views. 1913.

The rock formations exposed in this area are schists, slates, and quartzites of Algonkian age. Unconformably on these rocks in parts of the area lies a great series, at least 9000 feet thick, of Paleozoic quartzites, slates, and dolomitic limestones. During the late or early Cretaceous Eocene epoch these rocks were invaded by granite, quartz diorite, and diorite, which are probably outliers of the great central Idaho batholith. Dikes of granite, granite porphyry, and diorite porphyry, closely related in age to the granite rocks, are locally abundant in the western part of the area. In the central portion and along the eastern margin occur vast accumulations of Miocene lava and tuff, which occupy old erosion valleys. Morainic material covers much of the highlands.

The ore deposits comprise gold placers, and lodes carrying gold-silver, gold-copper, silver-copper, and lead-silver ores. The first three types of lodes are typically fissure fillings, but the fourth might equally well be considered of replacement origin. The gold-silver deposits are characterized by a highly siliceous gangue; the others by a siderite gangue.

Two distinct periods of mineralization are recognized in the area, the deposits of each being distinct in character and their age relations

clearly determinable. They are grouped as pre-Oligocene and post-Oligocene deposits. The latter are invariably inclosed in the Miocene eruptive rocks; the former in all the other rock formations. J. B. U.

GEOLOGY.—*The San Franciscan volcanic field, Arizona.* HENRY HOLLISTER ROBINSON. U. S. Geological Survey Professional Paper 76. Pp. 213, with maps, views, and sections. 1913.

The San Franciscan volcanic field, which takes its name from San Francisco Mountain, the largest volcano of the group, covers about 3000 square miles in the north central part of Arizona. The conspicuous features of the topography are the many volcanic cones rising to variable heights up to a maximum of 12,700 feet from a northward sloping plain 6000 to 7000 feet in altitude.

The oldest rocks of the region are the pure limestone of the Redwall formation, of Mississippian and Pennsylvanian age. The red sandstone of the Supai ("Lower Aubrey") formation, the crossbedded Coconino ("Upper Aubrey") sandstone, and the cherty Kaibab ("Upper Aubrey") limestone succeed one another in the order given and belong to the Pennsylvanian series. These four formations furnish a record of continuous marine sedimentation in shallow waters.

The Moencopie formation (Permian?), consisting of red sandstones and shales of fluviatile or shallow water origin, rests unconformably on the Kaibab limestone and in turn is separated by a slight unconformity from an overlying continental deposit of Triassic sandstone, shales, and marls. These Triassic rocks furnish the last record of sedimentation in this region, but a study of the surrounding country shows that deposition continued much longer and that Jurassic, Cretaceous, and possibly Eocene strata once covered the area.

Near the close of the Eocene epoch there was a period of folding and flexing, during the Miocene one of erosion and faulting, and in early Pliocene one of peneplanation. Extending from the late Pliocene to late Quaternary time there were three general periods of volcanic activity separated by intervals of quiescence, marked by faulting, uplift, and extensive erosion. The phenomena of the first volcanic period were of a simple nature and consisted of widespread eruptions of basalt from small cones. During the second period various lavas, ranging from andesites to rhyolites, were erupted and built up a few large cones. These cones, their history, their volume, together with the volume of the individual lavas, and the amount of erosion since the cessation of volcanic activity are described in detail. This period was

further marked by laccolithic and semilaccolithic intrusions contemporaneous with the volcanic extrusions. The third period closely resembled the first in that it witnessed the eruption of a single lava—a basalt—but it was characterized by the formation of a larger number of cones and a less widespread distribution of the lava.

The occurrence, megascopic and microscopic character, crystallinity, together with the chemical and mineral composition of 23 types of rocks ranging from a biotite rhyolite to an augite basalt are described in detail and compared to certain "Reference types" established by averaging the analyses of certain subrangs of the quantitative system of classification. The average lavas of the composite cones are found to have practically the same composition as the average lava of the second period of eruption; it is thought that differentiation occurred in a deep-seated zone and that the original composition of the magma was probably basaltic; and it is concluded that the lavas may be considered as representing all possible members of the igneous series which could form under the magmatic conditions existing in the San Franciscan region. Finally these lavas form a genetically related series of pronounced continuity and are the differentiation products of an originally homogeneous magma. These lavas were derived from the original magma, or originated according to the laws of chemical solution.

J. F. HUNTER.

HYDROLOGY.—*Underground water resources of Iowa.* W. H. NORTON, W. S. HENDRIXON, H. E. SIMPSON, O. E. MEINZER, and others. U. S. Geological Survey Water-Supply Paper No. 293. Pp. 994, with maps, section, and other illustrations. 1912. (Also published as a report of the Iowa Geological Survey.)

This paper is a comprehensive and detailed treatise on the underground waters of Iowa. Its chief contribution to geology consists of numerous carefully interpreted sections of deep wells and their correlation by the senior author. In the introductory chapter are outlined methods of collecting and studying sample drillings and of interpreting and correlating well sections. Paleozoic formations that outcrop in the northeastern part of the State are traced by means of well sections to the western part, where they are deeply buried under younger Paleozoic, Cretaceous, and Pleistocene deposits. A contour map of the upper surface of the St. Peter sandstone, one of the principal artesian aquifers, shows this formation to be about 1000 feet below sea level at Des Moines, and probably 2000 feet below at its lowest point, a short distance east of the southwestern corner of the State, toward which

point the Paleozoic formations seem to dip from the east, north, and west. According to the interpretations that are made, the Pennsylvanian series is 1400 feet thick in the southwestern part of the State and extends more than 300 feet below sea level.

The underground waters in the northeastern part of the State, where older Paleozoic formations outcrop, have low mineralization, the total solids generally being less than 500 parts per million, whereas in the other parts of the State, where Pennsylvanian and Upper Cretaceous rocks occur, the underground waters are generally highly mineralized.

O. E. M.

HYDROLOGY.—*Geology and water resources of Sulphur Spring Valley, Arizona.* O. E. MEINZER and F. C. KELTON. With a section on agriculture by R. H. FORBES. U. S. Geological Survey Water-Supply Paper No. 320. Pp. 231, with maps, views, and other illustrations. 1913. (Also published as a bulletin of the Arizona Agricultural Experiment Station.)

Sulphur Spring Valley is bordered by ranges in which are found pre-Cambrian schist Paleozoic quartzites and limestones, Cretaceous sedimentary rocks, and large masses of igneous and pyroclastic rocks, chiefly acidic lavas of Tertiary age. The valley is underlain by Quaternary sediments correlated with the Gila conglomerate and shown by well sections to be more than 1000 feet thick. Interbedded with the Quaternary stream deposits is a clay bed at least 200 feet thick, correlated with similar stratified beds in other valleys of southeastern Arizona, indicating a lake stage or general submergence probably early in the Pleistocene epoch. Later in the Pleistocene the valley contained a lake of 120 square miles, as is shown by 33 miles of well-developed beach ridges. Beds of basalt interbedded with stream deposits indicate two epochs of volcanic eruption during the Pleistocene.

The valley sediments contain a main body of ground water and smaller bodies of perched water. The ground water is derived from the drainage of adjacent mountains and is returned to the atmosphere through capillary rise over extensive alkali flats.

As shown by maps with lines of equal mineralization, the mineral content of the ground water is related to the character of the rocks in the adjacent mountains. Sodium carbonate waters having less than 200 parts per million of total solids are found adjacent to mountains composed of igneous rocks. The soluble salts tend to become concentrated near the surface by capillary rise and evaporation, but salt accumulations have in some places been buried under clastic sediments.

The valley is divided into six zones of native vegetation, the pronounced segregation of the dominant plant forms being due to radical differences in the geographic controls, chiefly soil, temperature, and water supply. O. E. M.

HYDROLOGY.—*Water resources of Antelope Valley, California.* HARRY R. JOHNSON. U. S. Geological Survey Water-Supply Paper No. 278. Pp. 89, with maps and other illustrations. 1911.

Antelope Valley, which lies in the southwestern part of the Mohave Desert, is enclosed by several mountain ranges in which are found metamorphic and granitic rocks, sandstones, shales, lavas, and tuff. The relief was produced chiefly by block faulting, but some of the sedimentary formations are much folded. The valley is underlain by gravels, sands, and clay derived through the erosion of the rocks in the mountains. In some places the valley deposits have been faulted and folded by recent earth movements, forming a well-defined ridge. They are waterbearing and give rise to flowing wells over an area of several townships. The artesian waters are derived from the floods discharged from mountain-sides bordering the valley and not from Owens Lake or other distant source, as is popularly believed. Alkaline clays and silt underlie the playas, where the ground water stands near the surface.
O. E. MEINZER.

HYDROLOGY.—*An intensive study of the water resources of a part of Owens Valley, California.* CHARLES H. LEE. U. S. Geological Survey Water-Supply Paper No. 294. Pp. 135, with maps, diagrams, and other illustrations. 1912.

The porous fill of Owens Valley occupies an impervious undrained rock basin, and the void spaces of the fill constitute an immense underground storage reservoir. The principal source of supply of this reservoir is percolation from precipitation in the valley and upon the tributary mountain areas. The principal discharge occurs through the flow of springs, the transpiration of plants, and the evaporation in low areas where the ground water is raised to the surface by capillarity. The accretions to and discharge from the underground reservoir were studied quantitatively in the Independence district of Owens Valley. The quantities discharged through evaporation and transpiration were determined for different depths to the water level by a series of tank experiments. For the district investigated it was found that loss by evaporation and transpiration occurs wherever the ground water stands within about 8 feet of the surface and that the amount varies inversely with the depth, being 50 or 60 inches a year where the ground water is

at the surface and zero where it is as much as 8 feet below the surface. The average discharge of ground water in the district was determined to be approximately 155 second-feet, of which 93 to 114 second-feet is contributed by soil evaporation and transpiration from grass and alkali lands. The available data indicate that this discharge is about equal to the accretions of ground water, as determined by observations on the percolation from streams and other sources of supply. O. E. MEINZER.

HYDROLOGY.—*Ground water in Boxelder and Tooele Counties, Utah.* EVERETT CARPENTER. U. S. Geological Survey Water-Supply Paper No. 333. Pp. 90, with maps and other illustrations. 1913.

The mountains under discussion, which were produced chiefly by block faulting, contain Paleozoic rocks ranging in age from Cambrian to Carboniferous, inclusive; also pre-Cambrian and Tertiary rocks. The intervening alluvial slopes and desert flats are underlain by unconsolidated sediments, chiefly Pleistocene. Lake Bonneville covered most of the area in the Pleistocene epoch.

The indurated rocks are not important as waterbearing formations but form huge reservoirs which contain unconsolidated sediments holding large quantities of water. Contributions to the underground supply are made by floods discharged over the alluvial slopes, and withdrawals occur on the valley flats and low deserts through the discharge of springs and through capillary rise. Where alkali flats occur ground water will be found near the surface. O. E. MEINZER.

PALEONTOLOGY—*Recurrent Tropidoleptus zones of the Upper Devonian in New York.* HENRY S. WILLIAMS. U. S. Geological Survey Professional Paper 79. Pp. 103, with 6 plates. 1913.

The area covered by this investigation is included almost wholly in the Watkins Glen and Catatonk quadrangles, lying in south-central New York. In this investigation 1411 separate faunules were collected and examined from the Watkins Glen and Catatonk quadrangles and 103 more from the adjoining Cortland quadrangle. All the faunules which contained either *Tropidoleptus carinatus*, *Rhipidomella vanuxemi* or closely allied forms, or *Spirifer marcyi*, *Cypricardella bellistriata*, *Delthyris mesicostalis*, *Phacops rana*, and other species either recorded in the Hamilton faunas or closely allied to them were critically examined. Most of them are located in one or other of three definite zones in their respective sections. The author shows (1) that none of the species occur stratigraphically far above or below the immediate zones in which they are found, often in abundance, and (2) that several of them are habitually associated together. The faunules in each section contain-

ing any of these species are grouped together as recurrent Tropidoleptus zones, considering Tropidoleptus to be the most characteristic form.

The importance of the investigation lies chiefly in its disclosures in regard to the ancient geography of the region. Both the departure and the return of the fauna must have been due to diastrophic changes that at one time brought about conditions unfavorable to the continued existence of the fauna and at another time not only restored favorable conditions but also provided means for the remigration of the fauna into the region. Such changes may have resulted (1) from the alternate closing and reopening of an actual passageway which alternately prevented and permitted the access of the fauna and of waters favorable to them, or (2) from changes that affected the direction, character, or volume of existing ocean currents. DAVID WHITE.

ENTOMOLOGY.—*Observations on the life history of* Micromalthus debilis *Lec.* H. S. BARBER. Proceedings of the Entomological Society of Washington **15**: 31–38, pls. 2 and 3. April 9, 1913.

The few records and captures of this supposedly rare beetle from the original capture of adult and larva in 1874 are given, together with a preliminary account of the author's attempts to breed adults from larvae found in the vicinity of Washington. These attempts demonstrate an involved paedogenetic reproduction (the first case known among the beetles) through three types of larvae, but the development of the sexed adults is still unknown to the writer. Comparison is made with other examples of unusual reproduction. The systematic position of the species is considered doubtful. J. C. CRAWFORD.

ENTOMOLOGY.—*The dispersion of the gypsy moth.* A. F. BURGESS. Bureau of Entomology Bulletin 119: 1–62, pls. 1–16. 1913.

The present paper is an extended account of the spread of this species, *Porthetria dispar*, as observed principally in Massachusetts. The character of its spread is divided into two groups, local and long-distance spread; the former due to the transportation of caterpillars or egg clusters on carriages or wagons moving a short distance, or of egg clusters on driftwood; the latter due to shipment of egg clusters on lumber products, nursery stock, or boxes from the infested territory to outside points. Caterpillars may also be carried long distances on automobiles or trolley cars, and colonies have actually been established at a great distance from the mother colony by such means. The greatest factor in ready dispersion is that the first stage caterpillars are carried by winds. Extensive experiments were carried on to prove this, traps being moored in ponds or lakes, or put on tops of towers of various sorts in order to

catch against their surfaces caterpillars driven by winds. The larvae possess hairs, called aerostatic hairs, with a small globular swelling near the base, which are supposed to aid in bouyancy. J. C. CRAWFORD.

ENTOMOLOGY.—*The Argentine ant.* WILMON NEWELL and T. C. BARBER. Bureau of Entomology Bulletin 122: 1–98, pls. 1–13. June 26, 1913.

A detailed account of the life-history and habits of *Iridomyrnex humilis*. This introduced species, found thus far in Louisiana, Mississippi, Alabama, and California, is extremely destructive to foods in houses and stores and also to crops, owing to its habit of protecting injurious insects which feed upon the sugar cane and corn. Its presence in orange groves is followed by rapid increase of destructive scale-insects on the trees, causing severe injury. In cotton fields where the boll weevil is present it is indirectly the cause of damage by annihilating native ants which destroy many of the immature stages of the boll weevil. It may also be found presently to be an important agent in the spread of disease, since individuals congregate in great numbers around garbage pails, etc., and are frequently hard to keep out of sick rooms. Methods of natural control and of repression, including the use of repellents and insecticides, are discussed. J. C. CRAWFORD.

ANTHROPOLOGY.—*Preliminary report on the linguistic classification of Algonquian tribes.* T. MICHELSON. 28th Ann. Rept. Bur. Amer. Ethnology, pp. 221–290b. 1912 [pub. 1913].

Algonquian tribes linguistically fall into four major divisions—Blackfoot, Cheyenne, Arapaho, and Eastern-Central. The Eastern-Central major division is divisible into two subtypes, Central and Eastern. The Central subtype has, furthermore, groupings within itself: Cree-Montagnais, Menominee, Sauk, Fox, Kickapoo, and Shawnee; Ojibwa, Ottawa, Potawatomi, Algonkin, and Peoria, together with Miami, etc.; Delaware and Munsee; and Natick. The Eastern subtype may be divided into two groups—Micmac, on the one hand, and the other extant dialects (Abnaki, Penobscot, Passamaquoddy, Malecite), which collectively may be designated Abnaki, on the other. The intimate connection of Eastern Algonquian with Sauk, Fox, Kickapoo, as well as with Shawnee, should be emphasized. The above classification is based on a study of the consonantic clusters of the various dialects, the pronouns of the present independent and subjunctive modes, together with certain phonetic and other considerations. The map showing the distribution and interrelation of the Algonquian dialects was prepared with the collaboration of Dr. John R. Swanton. T. M

ANTHROPOLOGY.—*Coos texts.* L. J. FRACHTENBERG. Columbia University Contributions to Anthropology **1**: 1–216. 1913.

These texts represent the Coos myths obtained in 1909 and those obtained by H. H. St. Clair, 2d, in 1903. The latter are normalized by Frachtenberg in his own phonetic scheme, save such words as are problematic. In these cases the correct form is given usually in footnotes. Interlinear translations accompany the first two myths, and these, as well as the vocabulary at the end, the list of suffixes, and the references to Frachtenberg's sketch of Coos grammar (Handbook of American Indian Languages, Bulletin 40, part 2, Bur. Amer. Ethnology, pp. 297–429) make it easy to follow the native text. L. J. F.

ELECTRICAL ENGINEERING.—*Electrolysis from electric railway currents and its prevention. An experimental test on a system of insulated return feeders in St. Louis.* E. B. ROSA, B. MCCOLLUM and K. H. LOGAN. Bureau of Standards Technologic Paper No. 32. (In press.)

The paper describes a comparative test on electrolysis conditions, first under a system of uninsulated return feeders, and then under an insulated feeder system, the same amount of copper being used in each test. Rail gradients were taken on a measured length of four feet of rail on all rails on both sides of each feeder tap. The average rail gradient with uninsulated feeders was 0.91 volts for the twenty-four hour period, and for the insulated feeders, 0.47 volts. Potential wires were placed 4 feet apart on 14 water and 7 gas pipes at points where the current on the pipes would probably be the largest. The average current flow on the pipes when the uninsulated feeder system was in operation was 5.7 times greater than under the insulated feeder system, there being no metallic connections between pipes and rails in either case. Potential differences between water pipes and rails observed at a large number of points, show a marked improvement under the insulated system. Twenty-two over-all potentials were measured between the tracks at the substation and the most distant feeding points. The average of those values was 10.4 volts with uninsulated and 2.6 volts with insulated feeders. The corresponding gradients in volts per thousand feet were 2.6 and 0.35 volts respectively. There is comparatively little difference in net cost of the two systems, while a summary of the test data shows that electrolysis conditions are very much better under the insulated return feeder system than under the uninsulated system.

G. K. BURGESS.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE BIOLOGICAL SOCIETY OF WASHINGTON

The 519th meeting was held at the Cosmos Club, January 10, 1914, with President PAUL BARTSCH in the chair. Five new members were elected.

The discussion of the previous meeting on Parallel Development was continued. L. STEJNEGER spoke of Parallelism as exhibited in reptiles, while BARTON W. EVERMANN and THEODORE GILL discussed it as related to fishes. Messrs. Eastman, Bartsch, A. D. Hopkins, and William Palmer also took part in the discussion.

The 520th meeting was held January 24, 1914, with President BARTSCH in the chair. Five persons were elected to membership.

The program consisted of three communications:

Winter bird-life in the swamps of Alabama: E. G. HOLT.

Pollen protection in the flowers of Acacia and Annona: W. E. SAFFORD.

The problem of the gliding gull: WILLIAM PALMER.

The 521st meeting was held February 7, 1914, President BARTSCH in the chair. One new member was elected. Two communications were presented:

Notes on the fossil mammals of the Fort Union: J. W. GIDLEY.

Certain seeds used for ornamental purposes in the West Indies: J. N. ROSE.

The 522d meeting was held February 21, 1914, Vice-President J. N. ROSE in the chair. The program consisted of three communications:

Seasonal movements of fishes at Lake Maxinkukee: BARTON W. EVERMANN:

An American Swastika: HENRY TALBOTT.

Surface temperature in the Humboldt current and its coastal eddies: R. E. COKER.

The 523d meeting was held March 7, 1914, with Vice-President A. D. Hopkins in the chair. Three persons were elected to membership. The program consisted of two communications:

Remains of a prehistoric feast: WILLIAM PALMER.

Further evidence of mutation in Oenothera (illustrated with lantern slides): H. H. BARTLETT.

The 524th meeting was held March 21, 1914, with President BARTSCH in the chair. Two new members were elected. Two communications were presented:

Arabic interpretations of the songs of birds: PAUL B. POPENOE.

Bird migration in the Mackenzie Valley (illustrated with lantern slides): WELLS W. COOKE.

D. E. LANTZ, *Recording Secretary.*

THE PHILOSOPHICAL SOCIETY OF WASHINGTON

The 734th meeting was held on January 17, 1914, at the Cosmos C ub, President FISCHER in the chair; 29 persons present. The minutes of the 730th, 731st, and 733d meetings were read and approved.

Mr. H. E. MERWIN presented a paper on *A formula for calculating solubility, vapor pressure, and optical dispersion.* An equation of the type $\frac{x_3-x_2}{y_3-y_2} = \frac{x_3-x_1}{y_3-y_1} + C(x_2 - x_1)$ can be written in the form of an equilateral hyperbola which does not pass through the origin. If x and y represent temperature and pressure, or temperature and solubility, or other sets of quantities that are used in graphs on rectangular coördinates, interpolations may be made. Or x and y may represent two temperatures at which pressures or solubilities, etc., of two substances are equal, thus expressing the relation of two similar curves, and making accurate interpolations possible for curves which are not readily representable by equations. The form of the curve of the equation is readily altered by putting $C(y_2 - y_1)$ in place of $C(x_2 - x_1)$, or by writing for the right hand member $\frac{x_3-x_1}{y_3-y_1} \cdot C^{\left(\frac{x_2-x_1}{y_2-y_1}\right)}$. Two standard solubility curves were described, and it was shown that many solubility curves are rectangular hyperbolas.

Mr. G. W. VINAL presented a paper, illustrated by lantern slides, *On certain electrochemical problems:* (*a*) *Reversibility of voltameter reactions,* (*b*) *Purity of silver deposits,* (*c*) *Ratio of silver to iodine,* (*d*) *Value of the Farady.* Since the complexion theory has been disproved by recent work at the Bureau of Standards, the question of reversibility was again investigated. Quantitatively the results show substantial agreement in loss at anode and gain at cathode. When a striated anode was used no such equivalence was found. Previous work on the inclusions of foreign material in the deposited silver was reviewed and the contradictory nature of the results pointed out. No conclusion can be drawn as to nature or amount of inclusions, but it is believed that they are very small in deposits made from the purest electrolyte. In striated deposits some evidence of included water was found. Comparative experiments in which the iodine voltameter (used by Dr. S. J. Bates) and the silver voltameter (porous cup and Smith forms) were compared afforded a new electrolytic method of determining the ratio of silver to iodine. The value 0.85017 was found, which is 22 parts in 100,000 higher than the ratio of the present international atomic

weights. The value for the electrochemical equivalent of iodine was determined to be 1.31052 mg. per coulomb. The value of the Farady (I = 126.92) is found to be 96,515. Value calculated from silver (Ag = 107.88) is 96,494, whence, for general use, round number 96,500 is recommended. The paper was discussed by Messrs. Hersey and Sosman.

The 735th meeting was held on January 31, 1914, at the Cosmos Club, Vice-President EICHELBERGER in the chair; 31 persons present. The minutes of the 734th meeting were read and approved.

Mr. W. P. WHITE presented a paper on *Thermostats of relatively high precision*. By the aid of a few simplifying assumptions, it is possible to give a very simple mathematical treatment of the ordinary mercury contact thermostat. The results showed that, in general, an increase in the precision of such a thermostat demands both an increase in the temperature sensitiveness and a decrease in the temperature lag. Since it is rather difficult to increase the sensitiveness and at the same time diminish the lag, it will be desirable to reduce as much as possible the heating rate, since this diminution diminishes the temperature lag. In many cases, a rather elaborate procedure in this direction may be the simplest way of increasing the precision. Some special devices which tend to obviate the difficulties encountered in the ordinary type of thermostat were mentioned. The paper was discussed by Messrs Miller and Gray.

Mr. F. E. WRIGHT presented a paper on *The measurement of crystallographic and optical properties at high temperatures*, illustrated by an exhibition of instruments. The basis of crystallography is the law, discovered in 1669 by Steno, of constancy of angle between crystal faces. The methods developed arose from consideration of possible changes in crystal angles with temperature changes. The furnace used for heating crystals and appurtenances were described. The cleavage angle of calcite changes one degree between 0° and 575°, the change being practically linear. Quartz shows much less change, about 11′ in the same temperature range; above 575° rate of change is rather less. Optical properties were also examined at different temperatures. Furnace attachment to regular microscope was described and exhibited. The paper was discussed by Messrs. White, Bowie, Priest, Burgess, Briggs, Agnew, Miller, Coblentz, and Fenner.

The 736th meeting was held on February 14, 1914, at the Cosmos Club, Vice-President EICHELBERGER in the chair; 25 persons present. The minutes of the 735th meeting were read and approved.

Mr. H. H. KIMBALL presented an illustrated paper on *The relation between the solar radiation intensities and the air temperatures for the northern hemisphere*. The speaker discussed the marked diminution in the intensity of direct solar radiation following the eruption of Katmai Volcano in June, 1912. There was an increase in the quantity of heat received diffusely from the sky, but the net result was a decrease in the

amount of heat energy received at the surface of the earth. The diminution in insolation has had a cooling effect on the temperature of the northern hemisphere as a whole, but in regions where storms are frequent and atmospheric circulation vigorous, this circulation has determined the character of the local temperature and, in some cases, has brought it above the normal rather than below. The paper was discussed by Messrs. Abbot and Bowie.

Mr. F. E. FOWLE then presented an illustrated paper on *Atmospheric transparency for radiation*. The transparency of the atmosphere on clear days is dependent on scattering due to three obstructions: the molecules of the air itself (dry air), the hindrances associated with water vapor (wet haze), and ordinary dust (dry haze). It is due to the change in these last two factors with the altitude that the quality of the transparency of the air, even with homogeneous rays, changes and that Bouguer's formula for atmospheric transmission may not be used in passing from one altitude to another. Above an altitude of 1000 meters on clear days the dry haze may become a negligible factor and the formula developed by the speaker can be used to compute the transparency to within 1 per cent. Above Mount Whitney (4420 meters) the wet haze on clear days may also become negligible. The paper was discussed by Mr. Abbot.

Mr. W. W. COBLENTZ then presented a paper on *The exudition of ice from plants*. Lantern slides were shown illustrating some beautiful forms. Messrs. Abbot, Wright, and Waite discussed the paper, particularly as regards the cause of the phenomenon noted.

J. A. FLEMING, *Secretary*.

REFERENCES

Under this heading it is proposed to include, by author, title, and citation, references to all scientific papers published in or emanating from Washington. It is requested that authors coöperate with the editors by submitting titles promptly, following the style used below. These references are not intended to replace the more extended abstracts published elsewhere in this JOURNAL.

PALEONTOLOGY

GIDLEY, J. W. *Notice of the occurrence of a Pleistocene camel north of the Arctic Circle.* Smithsonian Miscellaneous Collections **60**[26]: 1, 2. March 21, 1913. (Discusses the finding of one of the phalanges of a camel among fossil remains of *Elephas primigenius*, Equus, and Bison in Yukon Territory.—W. R. M.)

GIDLEY, J. W. *An extinct American eland.* Smithsonian Miscellaneous Collections **60**[27]: 1–3, pl. 1. 1913. (Describes *Taurotragus americanus*, sp. nov., from Pleistocene cave deposits near Cumberland, Maryland.—W. R. M.)

GILMORE, C. W. *A new dinosaur from the lance formation of Wyoming.* Smithsonian Miscellaneous Collections **61**[5]: 1–5, text figs. 1–5. May 24, 1913. (A preliminary paper describing *Thescelosaurus neglectus*, a new genus and species from Wyoming; referred provisionally to the family Camptosauridae. —W. R. M.)

HAY, O. P. *Descriptions of two new species of ruminants from the Pleistocene of Iowa.* Proceedings of the Biological Society of Washington **26**: 5–8. January 18, 1913. (Describes *Cervalces Roosevelti*, sp. nov.; also the new genus Aftonius, with a single member, *A. Calvini*, sp. nov.—W. R. M.)

HAY, O. P. *Description of the skull of an extinct horse found in central Alaska.* Smithsonian Miscellaneous Collections **61**[2]: 1–18, pls. 1, 2. June 4, 1913. (Includes description of *Equus niobrarensis alaskae*, subsp. nov.—W. R. M.)

JORDAN, D. S. *Ellima, a genus of fossil herrings.* Proceedings of the Biological Society of Washington **26**: 79. March 22, 1913. (The name Ellipes of Jordan, 1912, being preoccupied by Ellipes of Scudder, 1902, for a genus of crickets, the new name Ellima is proposed for the former genus of extinct clupeoid fishes.—W. R. M.)

BOTANY

BARTLETT, H. H. *Inheritance of sex forms in* Plantago lanceolata. Rhodora **15**: 173–178. October 17, 1913.

COCKERELL, T. D. A. *Some plants from New Mexico.* Proceedings of the Biological Society of Washington **26**: 203, 204. October 23, 1913. (Includes description of *Oenothera Hookeri Hewetti*, subsp. nov.—W. R. M.)

COLLINS, G. N. *A drought-resisting adaptation in seedlings of Hopi maize.* Journal of Agricultural Research **1**: 293–301, figs. 1 and 2, pls. 29–32. January, 1914.

COOK, O. F. *A new ornamental palmetto in southern Texas.* Bureau of Plant Industry Circular 113: 11–14. February 15, 1913. (Describes *Inodes exul* Cook.—W. R. M.)

COOK, O. F., AND DOYLE, C. B. *Three new genera of stilt palms (Iriarteaceae) from Colombia, with a synoptical review of the family.* Contributions from the U. S. National Herbarium **16:** 225–238, text fig. 41, pls. 54–65. February 21, 1913. (Includes descriptions of the new genera Acrostigma, Catostigma, and Catoblastus, each founded upon a single new species.—W. R. M.)

COOK, O. F. *Wild wheat in Palestine.* Bureau of Plant Industry Bulletin 274: 5–56, pls. 1–15, figs. 1–11. April 3, 1913.

COOK, O. F. *Relationships of the false date-palm of the Florida Keys, with a synoptical key to the families of American palms.* Contributions from the U. S. National Herbarium **16:** 243–254, pls. 74–77. May 14, 1913. (The new families Pseudophoenicaceae, Geonomaceae, Malortieaceae, Chamaedoraceae, Iriarteaceae, Synechanthaceae, and Acristaceae are here established.—W. R. M.)

GRIFFITHS, D. *Einige neue Opuntioideen.* Monats. Kakteenkunde **23:** 130–140. September 15, 1913. (Includes descriptions of seven new species of Opuntia and one of Nopalea.—W. R. M.)

HASSE, H. E. *The lichen flora of southern California.* Contributions from the U. S. National Herbarium **17:** 1–132. June 9, 1913.

HOLM, T. Phryma leptostachya *L., a morphological study.* Botanical Gazette **56:** 306–318, pls. 8–10. October 15, 1913.

KEARNEY, T. H., BRIGGS, L. J., SHANTZ, H. L., MCLANE, J. W., PIEMEISEL, R. L. *Indicator significance of vegetation in Tooele Valley, Utah.* Journal of Agricultural Research **1:** 365–417, figs. 1–13, pls. 42–48. February 16, 1914.

KRAUSE, K. *A new shrub of the genus Esenbeckia from Colombia.* Smithsonian Miscellaneous Collections **61**[16]: 1. September 29, 1913. (Describes *E. Pittieri*, sp. nov., allied to *E. leiocarpa* and *E. cornuta.*—W. R. M.)

MCATEE, W. L. *A list of plants collected on St. Vincent Island, Florida.* Proceedings of the Biological Society of Washington **26:** 39–52. March 22, 1913.

MCATEE, W. L. *Some local names of plants.* Torreya **13:** 225–236. October 14, 1913.

MASON, S. C. *The pubescent-fruited species of Prunus of the southwestern states.* Journal of Agricultural Research **1:** 147–177, figs. 1–8, pls. 9–16. November, 1913.

MAXON, W. R. *Studies of tropical American ferns—no. 5.* Contributions from the U. S. National Herbarium **17:** 391–425, pls. 11–23, text figs. 8–10. January 21, 1914. (Includes a revision of the American species of Oleandra, 6 out of the 11 recognized being described as new; extended notes upon *Polypodium duale* and related species; descriptions of 6 new species of Polypodium, 5 of these related to *P. trichomanoides;* descriptions of new species in several other genera; and a revision of the North American species of Hemitelia, section Euhemitelia.—W. R. M.)

MONTGOMERY, E. G. *Experiments in wheat breeding: experimental error in the nursery and variation in nitrogen and yield.* Bureau of Plant Industry Bulletin 269: 5–61, pls. 1–4, figs. 1–22. April 24, 1913.

PIPER, C. V. *Supplementary notes on American species of Festuca.* Contributions from the U. S. National Herbarium **16:** 197–199. February 11, 1913. (Includes description of *Festuca sororia*, sp. nov.—W. R. M.)

PIPER, C. V. Delphinium simplex *and its immediate allies.* Contributions from the U. S. National Herbarium **16:** 201–203. February 11, 1913. (Includes description of *D. cyanoreios*, sp. nov., from Idaho and Oregon.—W. R. M.)

PIPER, C. V. *The identity of* Heuchera cylindrica. Contributions from the U. S. National Herbarium **16:** 205, 206. February 11, 1913. (Includes description of *Heuchera chlorantha*, sp. nov.—W. R. M.)

PIPER, C. V. *New or noteworthy species of Pacific coast plants.* Contributions from the U. S. National Herbarium **16:** 207–210. February 11, 1913. (Seven new species are described in the genera Alsine, Pentstemon, Oreobroma, Aster, and Arabis.—W. R. M.)

RADLKOFER, L. *New Sapindaceae from Panama and Costa Rica.* Smithsonian Miscellaneous Collections **61**[24]: 1–8. February 9, 1914. (Describes 4 new species in Serjania, Paullinia, and Talisia; also the new genus Dipterodendron, with two species, one of which, *D. costaricense*, is new.—W. R. M.)

ROSE, J. N., AND STANDLEY, P. C. *The American species of Meibomia of the section Nephromeria.* Contributions from the U. S. National Herbarium **16:** 211–216, pl. 51. February 11, 1913. (*Meibomia Painteri*, *M. metallica*, and *M. angustata*, are described as new.—W. R. M.)

SAFFORD, W. E. *Raimondia, a new genus of Annonaceae from Colombia.* Contributions from the U. S. National Herbarium **16:** 217–219, pls. 52, 53. February 11, 1913. (Describes *Raimondia monoica*, a new genus and species.—W. R. M.)

SIEVERS, A. F. *Individual variation in the alkaloidal content of belladonna plants.* Journal of Agricultural Research **1:** 129–146, fig. 1. November, 1913.

STANDLEY, P. C. *A new Dodecatheon from New Mexico.* Proceedings of the Biological Society of Washington **26:** 195, 196. October 23, 1913. (Describes *Dodecatheon Ellisiae*, sp. nov.—W. R. M.)

SWINGLE, W. T. Citrus ichangensis, *a promising, hardy new species from southwestern China and Assam.* Journal of Agricultural Research **1:** 1–14, figs. 1–7, pl. 1. October, 1913.

SWINGLE, W. T., AND KELLERMAN, MAUDE. *Citropsis, a new tropical African genus allied to Citrus.* Journal of Agricultural Research **1:** 419–436, figs. 1–7, pl. 49. February, 1914.

TIDESTROM, I. *A new Salicornia.* Proceedings of the Biological Society of Washington **26:** 13, 14. January 18, 1913. (Describes *S. utahensis*, sp. nov., from Utah.—W. R. M.)

WOOTON, E. O., AND STANDLEY, P. C. Descriptions of new plants preliminary to a report upon the flora of New Mexico. Contributions from the U. S. National Herbarium **16:** 109–196, pls. 48–50. February 12, 1913.

PHYTOPATHOLOGY

BROOKS, C. *Quince blotch and apple fruit spot.* Phytopathology **3:** 249, 250. August, 1913.

BROWN, NELLIE A., AND JAMIESON, CLARA O. *A bacterium causing a disease of sugar-beet and nasturtium leaves.* Journal of Agricultural Research **1:** 189–210, figs. 1–5, pls. 17–19. December, 1913.

HARTER, L. L. *Foot-rot, a new disease of the sweet potato.* Phytopathology **3**: 243–245, figs. 1, 2. August, 1913. (Describes *Plenodomus destruens*, sp. nov., on stems of *Ipomoea Batatas*.—W. R. M.)

HARTER, L. L. *The foot-rot of the sweet potato.* Journal of Agricultural Research **1**: 251–273, fig. 1, pls. 23–28. December, 1913.

HARTLEY, C. *Twig canker on black birch.* Phytopathology **3**: 248, 249. August, 1913.

HARTLEY, C. *Bark rusts of* Juniperus virginiana. Phytopathology **3**: 249. August, 1913.

HEDGCOCK, G. G., AND LONG, W. H. *Notes on cultures of three species of Peridermium.* Phytopathology **3**: 250, 251. August, 1913.

HEDGCOCK, G. G., AND LONG, W. H. *An undescribed species of Peridermium from Colorado.* Phytopathology **3**: 251, 252. August, 1913. (Describes *Peridermium Betheli*, sp. nov.—W. R. M.)

INGRAM, DELLA E. *A twig blight of* Quercus prinus *and related species.* Journal of Agricultural Research **1**: 339–346, figs. 1–7, pl. 38. January, 1914.

LONG, W. H. *Three undescribed heart-rots of hardwood trees, especially of oak.* Journal of Agricultural Research **1**: 109–127, pls. 7 and 8. November, 1913.

LONG, W. H. Polyporus dryadeus, *a root parasite on the oak.* Journal of Agricultural Research **1**: 239–248, pls. 21 and 22. December, 1913.

LONG, W. H. *An undescribed species of Gymnosporangium from Japan.* Journal of Agricultural Research **1**: 353–356. January, 1914.

METCALF, H. *The chestnut bark disease.* Yearbook of the Department of Agriculture **1912**: 361–372, pls. 34–37. 1913.

RAND, F. V. *Some diseases of pecans.* Journal of Agricultural Research **1**: 303–337, figs. 1–8, pls. 33–37. January, 1914.

TAUBENHAUS, J. J. *The black rots of the sweet potato.* Phytopathology **3**: 159–166, pls. 14–16. August 1, 1913. (Includes description of *Sclerotium bataticola*, sp. nov.—W. R. W.)

ENTOMOLOGY

HOOD, J. D. *Nine new Thysanoptera from the United States.* Proceedings of the Biological Society of Washington **26**: 161–166. June 30, 1913.

HOPKINS, A. D. *Discontinuous geographical distribution.* Proceedings of the Entomological Society of Washington **15**: 118–121. October 2, 1913. (The occurrence of closely related species in widely separated localities is credited to parallel evolution under long-continued similar environments from a common primitive ancestral base.—J. C. C.)

KNAB, F. *A new bot-fly from reindeer.* Proceedings of the Biological Society of Washington **26**: 155, 156. June 30, 1913. (Describes *Oedenagena terraenovae*, from Newfoundland.—J. C. C.)

PAINE, J. H. *A new genus of Mallophaga from African Guinea fowl in the United States National Museum.* Smithsonian Miscellaneous Collections **61**[23]: 1–4, text fig. 1. January 31, 1914. (Describes *Somaphontus lusius*, new genus and species, upon specimens taken from *Numida ptilorhyncha*.—W. R. M.)

PARKER, W. B. *A sealed paper carton to protect cereals from insect attack.* Bulletin of the U. S. Department of Agriculture, No. 15. Pp. 1–8. October 16, 1913. (Discusses briefly the advisability of using a sealed paper carton, showing its efficiency and the non-efficiency of the unsealed packages.—J.C.C.)

PIERCE, W. D. *The occurrence of a cotton boll weevil in Arizona.* Journal of Agricultural Research **1**: 89–96, figs. 1–9, pl. 6. November, 1913.

PIERCE, W. D. *New potato weevils from Andean South America.* Journal of Agricultural Research **1**: 347–351, figs. 1–3, 39–41. January, 1914.

QUAINTANCE, A. L. *Remarks on some of the injurious insects of other countries.* Proceedings of the Entomological Society of Washington **15**: 54–83. June 10, 1913. (For the economic entomologists the author has brought together notes on the important injurious insects of all orders, giving the type of injury of the various species.—J. C. C.)

QUAINTANCE, A. L., AND BAKER, A. C. *Classification of the Aleyrodidae—Pt. I.* Bureau of Entomology, Technical Series, No. 27, Pt. 1, pp. 1–93, pls. 1–34. March 6, 1913. (In this paper, which treats of the species of the whole world, one new subfamily, the two new genera Leonardius and Neomaskellia, the two new subgenera Lecanoideus and Metaleurodicus, and eight new species are described.—J. C. C.)

ROHWER, S. A. *A new braconid from South America.* Proceedings of the Entomological Society of Washington **15**: 144. October 2, 1913.

ROHWER, S. A. *VI. Chalcidids injurious to forest-tree seeds.* Bureau of Entomology, Technical Series, No. 20, Pt. 6, pp. 157–163. February 10, 1913. (Contains notes on the habits of the species of the genus Megastigmus and *Syntomaspis druparum.*—J. C. C.)

RUSSELL, H. M. *Observations on the egg parasites of* Datana integerrima *Walk.* Proceedings of the Entomological Society of Washington **15**: 91–97. June 10, 1913. (Four species are recorded, three of these being chalcids.—J. C. C.)

SASSCER, E. R. *An index to catalogues of recently described Coccidae included in Technical Series Nos. 12 and 16.* Bureau of Entomology, Technical Series, No. 16, Pt. 7, pp. 99–116. January 23, 1913.

SASSCER, E. R., AND PIERCE, W. D. *Preliminary report of the finding of a new weevil enemy of the potato tuber.* Proceedings of the Entomological Society of Washington **15**: 143, 144, pls. 4, 5. October 2, 1913. (Records the finding of *Rhigopsidius tucumanus* in potato from Peru, Bolivia and Chile, and states that the injury is not noticeable externally, so that there is danger of the importation of this injurious insect.—J. C. C.)

SCHAUS, W. *Two new noctuids from French Guiana (Lepidoptera, Noctuidae).* Insecutor Inscitiae Menstruus **1**: 25, 26. March 29, 1913. (Describes *Celiptera therides* and *Safia olearos.*—J. C. C.)

SCOTT, E. W., AND SIEGLER, E. H. *Lime-sulphur as a stomach poison for insects.* Bureau of Entomology Bulletin 116, Pt. 4, pp. 81–90, pl. 11. January 17, 1913. (The experiments were conducted at Benton Harbor, Mich.—J. C. C.)

SNYDER, T. E. *Record of the rearing of* Cupes concolor *Westw.* Proceedings of the Entomological Society of Washington **15**: 30, 31, pl. 1. April 9, 1913.

SNYDER, T. E. *The ovipositor of* Parandra brunnea *Fab.* Proceedings of the Entomological Society of Washington **15**: 131, 133. October 2, 1913. (A discussion of the anatomy of the ovipositor.—J. C. C.)

TOWNSEND, C. H. T. *A new genus of Streblidae.* Proceedings of the Entomological Society of Washington **15**: 98, 99. June 10, 1913. (Describes the new genus Synthesiostrebla, with one new species, from Peru.—J. C. C.)

TOWNSEND, C. H. T. *Preliminary characterization of the vector of verruga,* Phlebotomus verrucarium, *sp. nov.* Insecutor Inscitiae Menstruus **1**: 107–109, pl.

3. September 15, 1913. (In describing this new species the author states that "although the transmission of verruga by means of the species . . . . has not yet been accomplished, it is now practically certain from the entomological standpoint, considered in connection with the very peculiar conditions of the verruga zones, that it is the vector, if not the true intermediary host, of the causative organism of the disease."—J. C. C.)

TOWNSEND, C. H. T. *Criticism and muscoid taxonomy.* Insecutor Inscitiae Menstruus **1**: 115–117. September 15, 1913. (A reply to certain criticisms of articles by the author, with mention of material and data regarded as essential to a proper classification of the muscoid flies.—J. C. C.)

TOWNSEND, C. H. T. *New muscoid flies, mainly Hystriciidae and Pyrrhosiinae from the Andean Montanya.* Insecutor Inscitiae Menstruus **1**: 144–148. November 29, 1913. (To be continued; this part contains a general introduction, with description of the region and notes on tribal characters.—J. C. C.)

VIERECK, H. L. *Descriptions of ten new genera and twenty-three new species of Ichneumon-flies.* Proceedings of the U. S. National Museum **44**: 555–568. April 18, 1913. (Describes the new genera Coelinidea and Ericoelinius in the family Alysiidae; Atanycolimorpha, Coeloidimorpha, and Hysterobolus in the Braconidae; Chroistlimorpha, Diapetimorpha, Ethaemorpha, Mesostenimorpha, and Orthocryptus in the Ichneumonidae.—J. C. C.)

WALTON, W. R. *Efficiency of a tachnid parasite on the last instar of Laphygma.* Proceedings of the Entomological Society of Washington **15**: 128–131. October 2, 1913. (A study of the effectiveness of parasitism by Tachinidae, the maximum number of adult Tachinids to issue from one individual host, and the effect, if any, of the deposition of supernumerary eggs on the development of the resulting adult flies.—J. C. C.)

WALTON, W. R. *The variation of structural characters used in the classification of some muscoidean flies.* Proceedings of the Entomological Society of Washington **15**: 21–28. April 9, 1913. (Gives examples of the variation of chaetophorous characters in various species.—J. C. C.)

WEBSTER, F. M. *The Southern corn rootworm, or budworm.* Bulletin of the U. S. Department of Agriculture, No. 5, pp. 1–11. September 27, 1913. (An account of food-plants of the larvae, the amount of damage to corn, seasonal history of the insect, natural enemies, and suggestions for remedial and preventative measures.—J. C. C.)

WEBSTER, F. M., AND PARKS, T. H. The serpentine leaf-miner. Journal of Agricultural Research **1**: 59–87, fig. 1–17, pl. 5. October, 1913.

WELD, L. H. *A new oak gall from Mexico (Hymenoptera, Cynipidae).* Insecutor Inscitiae Menstruus **1**: 132–134, pl. 4. October 30, 1913. (Describes the gall, its market, and a new species of inquiline.—J. C. C.)

WOGLUM, R. S. *Report of a trip to India and the Orient in search of the natural enemies of the Citrus white fly.* Bureau of Entomology Bulletin 120: 1–58, pls. 1–12. February 28, 1913. (An internal parasite of the white fly, *Aleyrodes citri*, was discovered in India; but, since specimens shipped to the United States arrived during the winter months and thus could not be established, the possibility of their being able to survive in this climate and their subsequent efficiency are problematical.—J. C. C.)

VIRUS